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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample and a personnel evaluation form are also included. (AG)

October 1969 United States Training and Employment Service Technical Report S-443

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# Development of USTES Aptitude Test Battery

# for

# Molded-Goods Inspector-Trimmer

## (rubber goods) 759.687

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MANPOWER ADMINISTRATION

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# Technical Report on Development of USTES Aptitude Test Battery For . . . . . .

## Molded-Goods Inspector-Trimmer (rubber goods) 759.687

S-443

(Developed in Cooperation with the
Ohio State Employment Service)

U. S. Department of Labor
Manpower Administration
October 1969

## FOREWORD

The United States Training and Employment Service General Aptitude Test Battery (GATB) was first published in 1947. Since that time the GATB has been included in a continuing program of research to validate the tests against success in many different occupations. Because of its extensive research base the GATB has come to be recognized as the best validated multiple aptitude test battery in existence for use in vocational guidance.

The GATB consists of 12 tests which measure 9 aptitudes: General Learning Ability, Verbal Aptitude, Numerical Aptitude, Spatial Aptitude, Form Perception, Clerical Perception, Motor Coordination, Finger Dexterity, and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, with a standard deviation of 20.

Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, in combination, predict job performance. For any given occupation, cutting scores are set only for those aptitudes which contribute to the prediction of performance of the job duties of the experimental sample. It is important to recognize that another job might have the same job title but the job content might not be similar. The GATB norms described in this report are appropriate for use only for jobs with content similar to that shown in the job description included in this report.

GATB Study #2770

# DEVELOPMENT OF USTES APTITUDE TEST BATTERY

For

Molded-Goods Inspector-Trimmer (rubber goods) 759.687-042

S-443

This report describes research undertaken for the purpose of developing General Aptitude Test Battery (GATB) norms for the occupation of Molded-Goods Inspector-Trimmer (rubber goods) 759.687-042. The following norms were established:

| GATB Aptitudes | Minimum Acceptable GATB Scores |
|---|---|
| Q - Clerical Perception | 90 |
| K - Motor Coordination | 85 |
| M - Manual Dexterity | 85 |

## RESEARCH SUMMARY

**Sample:**

50 female workers employed as Molded-Goods Inspector-Trimmers or as Rubber-Goods Inspector-Trimmers (rubber goods) at the Goodyear Tire and Rubber Company plant located at St. Marys, Ohio. All individuals in this sample were non-minority group members.

**Criterion:**

Supervisory ratings.

**Design:**

Longitudinal-test data were collected from December 12, 1956, through November 3, 1968, and criterion data were collected from November 26, 1968, through April 21, 1969.

Minimum aptitude requirements were determined on the basis of a job analysis, and statistical analyses of aptitude mean scores, standard deviations, and selective efficiencies.

Predictive Validity:

Phi Coefficient = .37 ($P/2 < .005$)

Effectiveness of Norms:

Only 68% of the non-test-selected workers used for this study were good workers; if the workers had been test-selected with the above norms, 79% would have been good workers. 32% of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the above norms, only 21% would have been poor workers. The effectiveness of the norms is shown graphically in Table 1:

TABLE 1

Effectiveness of Norms

| | Without Tests | With Tests |
|---|---|---|
| Good Workers | 68% | 79% |
| Poor Workers | 32% | 21% |

VALIDATION SAMPLE DESCRIPTION

Size:

N = 50

Occupational Status

Employed Workers

Work Setting:

Workers were employed at the Goodyear Tire and Rubber Company plant at St. Marys, Ohio.

Employer Selection Requirements:

Education: prefer high school graduates

Experience: no requirement

Tests: GATB and SRA nonverbal. A review of test data indicates that S-17 cut off scores were not rigidly followed.

Other: Physical examination including back X-Ray, Interview, Minimum height, 5'2" with proportionate weight.

Principal Activities:

The job duties for each worker are those shown in the job description on the Fact Sheet.

Minimum Experience:

No requirement. Entry level job.

TABLE 2

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for Age, and Education.

| | Mean | SD | Range | r |
|---|---|---|---|---|
| Age (years) | 37.7 | 9.3 | 22-62 | .058 |
| Education (years) | 11.1 | 1.6 | 8-16 | .118 |

EXPERIMENTAL TEST BATTERY

All twelve tests of the GATB B-1002, Form A, were administered to the validation sample during the period December 12, 1956, through November 3, 1968. This testing was done by the St. Marys' local office prior to referral to Goodyear.

## CRITERION

The criterion data consisted of supervisor's ratings of job proficiency collected during the period November 26, 1968, through April 21, 1969.

Rating Scale:

A special rating scale was developed for this study. The scale (see Appendix) included seven items of USTES Form SP-21, Descriptive Rating Scale, and five items developed to measure performance on specific aspects of the job identified by the supervisor as being important. The scale contained twelve items covering different aspects of job performance with five alternative levels of performance for each.

Reliability:

A reliability coefficient of .72 was obtained between the two ratings. In most cases the rating was done by two different raters. The final criterion consisted of the combined scores of the two ratings.

Criterion Score Distribution:

| | |
|---|---|
| Possible Range: | 24-120 |
| Actual Range: | 53-105 |
| Mean: | 83.2 |
| Standard Deviation: | 11.4 |

Criterion Dichotomy:

The criterion distribution was dichotomized into high and low groups by placing 32% of the sample in the low group and 68% into the high criterion group. Workers in the high criterion group were designated as "good workers" and those in the low criterion group as "poor workers". The criterion critical score is 80.

## APTITUDES CONSIDERED FOR INCLUSION IN THE NORMS

Aptitudes were selected for tryout on the basis of a qualitative analysis of job duties involved and statistical analyses of test and criterion data. Aptitudes P, K, and M which do not have a high correlation with the criterion, were considered for inclusion in the norms because a qualitative analysis indicated that they were important to the job duties and the sample had a relatively high mean score on these aptitudes. With employed workers a relatively high mean score indicates that some sample pre-selection may have taken place. Although the correlation between aptitude Q and the criterion was not significant, it was decided to give the aptitude further consideration based on its high correlation. Tables 3, 4, and 5, show the results of the qualitative and statistical analyses.

### TABLE 3

### QUALITATIVE ANALYSIS

(Based on the job analysis, the aptitudes indicated appear to be important to the work performed.)

| Aptitude | Rationale |
|---|---|
| P - Form Perception | Required to inspect diaphragms for cracks, tears, and other defects. |
| K - Motor Coordination | Required to handle items while using knife to trim excess; required to stretch diaphragm over template, rotating and inspecting at the same time. Performance indicates importance of eye and hand coordination. |
| M - Manual Dexterity | Required to trim molded rubber products by using "V" blade knife or scissors and then pack products into cartons. |

TABLE 4

Means, Standard Deviations (SD), Ranges and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB

| Aptitude | Mean | SD | Range | r |
|---|---|---|---|---|
| G - General Learning Ability | 102.5 | 16.8 | 63-140 | .018 |
| V - Verbal Aptitude | 101.7 | 17.8 | 70-164 | -.054 |
| N - Numerical Aptitude | 101.1 | 16.0 | 57-138 | .179 |
| S - Spatial Aptitude | 102.0 | 20.0 | 55-143 | .091 |
| P - Form Perception | 107.9 | 19.8 | 63-146 | -.037 |
| Q - Clerical Perception | 106.4 | 15.6 | 74-139 | .253 |
| K - Motor Coordination | 107.3 | 16.8 | 66-148 | .090 |
| F - Finger Dexterity | 107.5 | 17.4 | 65-146 | .010 |
| M - Manual Dexterity | 114.9 | 19.0 | 75-156 | .158 |

TABLE 5

SUMMARY OF QUALITATIVE AND QUANTITATIVE DATA

| Type of Evidence | Aptitudes | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Job Analysis Data: | G | V | N | S | P | Q | K | F | M |
| Important | | | | | X | | X | | X |
| Irrelevant | | | | | | | | | |
| Relatively High Mean | | | | | X | | X | X | X |
| Relatively Low Standard Deviation | | | | | | | | | |
| Significant Correlation with Criterion | | | | | | | | | |
| Aptitudes to be Considered for Trial Norms | | | | | P | Q* | K | | M |

*Although not significant, this aptitude had the highest correlation with the criterion and a decision was made to include it for further consideration based on its high correlation.

DERIVATION AND VALIDITY OF NORMS

Final norms were derived on the basis of a comparison of the degree to which trial norms consisting of various combinations of P, Q, K, and M at trial cutting scores were able to differentiate between 68% of the sample considered good workers and 32% of the sample considered poor workers. Trial cutting scores at five point intervals approximately one standard deviation below the mean are tried because this will eliminate about one-third of the sample with three-aptitude norms. For two-aptitude trial norms, cutting

scores of slightly higher than one standard deviation below the mean will eliminate about one third of the sample. The Phi Coefficient was used as a basis for comparing trial norms. Norms of Q-90, K-85 and M-85 provided optimum differentiation for the occupation of Molded-Goods Inspector-Trimmer 759.687-042. The validity of these norms is shown in Table 6 and is indicated by a Phi Coefficient of .37 (statistically significant at the .005 level).

TABLE 6

Predictive Validity of Test Norms, Q-90, K-85, and M-85

| | Nonqualifying Test Scores | Qualifying Test Scores | Total |
|---|---|---|---|
| Good Workers | 4 | 30 | 34 |
| Poor Workers | 8 | 8 | 16 |
| Total | 12 | 38 | 50 |

Phi Coefficient ($\phi$) = .37
Significance Level = $P/2 < .005$
Chi Square ($\chi^2_y$) = 6.8

## DETERMINATION OF OCCUPATIONAL APTITUDE PATTERN

The data for this study did not meet the requirements for incorporating the occupation studied into any of the 36 OAP's included in Section II of the Manual for the General Aptitude Test Battery. The data for this sample will be considered for future groupings of occupations in the development of new occupational aptitude patterns.

SP-21
Rev. 5/67

**Special Rating Scale**

UNITED STATES EMPLOYMENT SERVICE

DESCRIPTIVE RATING SCALE
(For Aptitude Test Development Studies)

SCORE_____

RATING SCALE FOR RUBBER GOODS INSPECTOR TRIMMER
D.O.T. Title and Code

Directions: Please read the sheet "Suggestions to Raters" and then fill in the items listed below. In making your ratings, only one box should be checked for each question.

Name of worker (print) _____
(Last) (First)

Sex: Male _____ Female _____

Company Job Title: _____

AA. How often do you see this worker in a work situation?

1.___ See him at work all the time.

2.___ See him at work several times a day.

3.___ See him at work several times a week.

4.___ Seldom see him in work situation.

BB. How long have you worked with him?

1.___ Under one month.

2.___ One to two months.

3.___ Three to five months.

4.___ Six months or more.

A. How much work can he get done? (Worker's ability to make efficient use of his time and to work at high speed.)

1.____ Capable of very low work output. Can perform only at an unsatisfactory pace.

2.____ Capable of low work output. Can perform at a slow pace.

3.____ Capable of fair work output. Can perform at an acceptable but not fast pace.

4.____ Capable of high work output. Can perform at a fast pace.

5.____ Capable of very high work output. Can perform at an unusually fast pace.

B. How good is the quality of his work? (Worker's ability to do high-grade work which meets quality standards.)

1.____ Performance is inferior and almost never meets minimum quality standards.

2.____ The grade of his work could stand improvement. Performance is usually acceptable but somewhat inferior in quality.

3.____ Performance is acceptable but usually not superior in quality.

4.____ Performance is usually superior in quality.

5.____ Performance is almost always of the highest quality.

C. How accurate is he in his work? (Worker's ability to avoid making mistakes.)

1.____ Makes very many mistakes. Work needs constant checking.

2.____ Makes frequent mistakes. Work needs more checking than is desirable.

3.____ Makes mistakes occasionally. Work needs only normal checking.

4.____ Makes few mistakes. Work seldom needs checking.

5.____ Rarely makes a mistake. Work almost never needs checking.

D. How much does he know about his job? (Worker's understanding of the principles, equipment, materials and methods that have to do directly or indirectly with his work.)

1.____ Has very limited knowledge. Does not know enough to do his job adequately.

2.____ Has little knowledge. Knows enough to "get by."

3.____ Has moderate amount of knowledge. Knows enough to do fair work.

4.____ Has broad knowledge. Knows enough to do good work.

5.____ Has complete knowledge. Knows his job thoroughly.

E. How much aptitude or facility does he have for this kind of work? (Worker's adeptness or knack for performing his job easily and well.)

1.____ Has great difficulty doing his job. Not at all suited to this kind of work.

2.____ Usually has some difficulty doing his job. Not too well suited to this kind of work.

3.____ Does his job without too much difficulty. Fairly well suited to this kind of work.

4.____ Usually does his job without difficulty. Well suited to this kind of work.

5.____ Does his job with great ease. Exceptionally well suited for this kind of work.

F. How large a variety of job duties can he perform efficiently? (Worker's ability to handle several different operations in his work.)

1.____ Cannot perform different operations adequately.

2.____ Can perform a limited number of different operations efficiently.

3.____ Can perform several different operations with reasonable efficiency.

4.____ Can perform many different operations efficiently.

5.____ Can perform an unusually large variety of different operations efficiently.

G. How well does he remember directions? (Worker's ability to remember work routine and instructions.)

1. ___ Has very great difficulty remembering directions. Very often forgets. Must be continually reminded and corrected.

2. ___ Has considerable difficulty remembering directions. Often needs straightening out.

3. ___ Can remember directions fairly well. Occasionally forgets or needs correcting.

4. ___ Has no difficulty remembering directions. Seldom forgets or needs correcting.

5. ___ Remembers directions exceptionally well. Almost never forgets or needs correcting.

H. How much attention does he pay to details? (Worker's ability and inclination to pay attention to small variations and differences or to specific procedures.)

1. ___ Pays almost no attention to details. Very often overlooks important details.

2. ___ Does not pay enough attention to details. Often misses important ones.

3. ___ Pays a fair amount of attention to details. Occasionally misses important ones.

4. ___ Pays considerable attention to details. Seldom overlooks important ones.

5. ___ Pays very close attention to details. Very seldom misses even the smallest detail.

J. How well can this worker estimate the quality of an object? (Worker's ability to judge how good or how bad a piece of work is and to decide how much work is needed to bring it up to standard.)

1. ___ Is a very poor judge of quality. Cannot tell a good piece of work from a bad one.

2. ___ Has considerable difficulty telling whether a piece of work is adequate. Often makes incorrect judgements.

3. ___ Can usually tell whether a piece of work is adequate. Fair judge of quality.

4. ___ Has no difficulty estimating the quality of an object. Can identify bad products readily. Good judge of quality.

5. ___ Almost never makes an error in judging the quality of a piece of work.

K. How well adapted is he for doing repetitive work? (Worker's ability to do the same operation or a very small number of tasks over and over again.)

1. ___ Is not suited for doing repetitive work. Cannot adapt himself to doing the same job over and over again.

2. ___ Has considerable difficulty performing on a repetitive job. Poorly suited for doing repetitive work.

3. ___ Can perform adequately on a repetitive job. Adapts fairly well to repetitive work.

4. ___ Has no difficulty performing on a repetitive job. Well adapted for repetitive work.



5. ___ Is exceptionally well adapted for repetitive work. Can very readily repeat the same operation all day.

L. How well adapted is he for inside work? (Worker's ability to work indoors.)

1.___ Has very great difficulty working indoors. Not adapted for inside work. Definitely does not like working inside.

2. ___ Has considerable difficulty working indoors. Somewhat dislikes inside work.

3. ___ Can work fairly well inside. Is satisfied working indoors.

4. ___ Performs well indoors. Likes working inside.

5. ___ Works best indoors. Definitely prefers inside work.

M. Considering all the factors already rated, and only these factors, how acceptable is his work? (Worker's "all-around ability" to do his job.)

1. ___ Would be better off without him. Performance usually not acceptable.

2. ___ Of limited value to the organization. Performance somewhat inferior.

3. ___ A fairly proficient worker. Performance generally acceptable.

4. ___ A valuable worker. Performance is usually superior.

5. ___ An unusually competnet worker. Performance almost always top notch.

FACT SHEET

Job Title: **Molded-Goods Inspector-Trimmer** (rubber goods) 759.687-042

Job Summary: Performs several miscellaneous trimming as well as meticulous inspecting functions, by peeling rind, trimming with scissors, stretching over jig then soap stoning prior to boxing for shipment to customer. Worker may also trim molded rubber products, using "V" Blade, straight bladed knife, and scissors, to affect smooth close trim of rubber flash, inspecting for defects, that product might be packed for shipment, or returned for repairs.

Work Performed: Specific duties and items being trimmed and inspected may differ for some workers. Some workers pick up diaphragm while standing at bin. Pull rind from diaphragm and toss to end of bin, while tossing diaphragm to workbench to an accumulated quantity of approximately seventy. Walk several steps to workbench, and sit on high-backed stool. Start inspection/trim operation comprising 7 to 30 seconds per unit, according to the condition of the perimeter after rind is peeled off. Pick up one diaphragm and place over template. Rotate, making inspection and flexing rubber at I. D. and perimeter. Inspect for cracks, tears, and other visual defects. Discard imperfect units in salvage bin on floor. Use scissors to trim excess rind which did not peel off in first operation. Place in cardboard box to left of work area, to a quantity of approximately 40 pieces.

Then put on canvas gloves. Shake talc or soap stone, over accumulated quantity of trimmed, imspected diaphragms in box. Rub each diaphragm evenly distributing talc to prevent sticking together. May find defect after powder is applied which was not visible before, and discard piece in salvage bin. Stack talced diaphragms on left hand, placing newly inspected diaphragm on top, and rotate to distribute talc, to a quantity of ten. Nests twenty diaphragms over previously formed cardboard stapled rings in a compartment of shipping carton, totaling 360; then lid the carton that an additional 360 units can be added for a total shipment of 720 per carton. May be required to make up rings by stapling with regular heavy duty stapling machine.

Some workers pick up Deck Chutes from bin, to working quantity of approximately twenty-five, placing same with large opening down, on workbench. Pick up "V" knife in right hand, and grasp Deck Chute top with left hand. Trim rubber flash from outside diameter of chute (perimeter of large end.) Inspect for defects, including cracks, blisters and discoloration while rotating piece. Continue use of "V" knife and trim flash from flange, and stack trimmed chutes on bench approximately four high.

Next pull high chair to adjacent bench/carton work position. Pick up one piece, holding on lap while sitting on chair. Use straight pointed knife to skewer flash from three holes in flange. Complete trim of rind from I. D. of chute, inspecting interior as well as exterior by rotation in hand. Place trimmed, inspected chute in carton, 12 units to each layer, with divider, 36 chutes per carton. Place defective, but repairable chutes, in separate bin for return to proper department for repairs. Throw scrap into salvage bins. Make out Inspection Tag, and place in bin, before it is removed by Material Handler.

Effectiveness of Norms: Only 68% of the non-test-selected workers used for this study were good workers; if the workers had been test-selected with the S-443 norms, 79% would have been good workers. 32% of the non-test-selected workers used for this study were poor workers; if the workers had been test-selected with the S-443 norms, only 21% would have been poor workers.

Applicability of S-443 Norms: The aptitude test battery is applicable to jobs which embody a majority of the duties described above.



GPO 888-042